

Application No. 10/512,104  
Amendment date April 24, 2006  
Reply to Office action of January 24, 2006

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Currently Amended) A multi-contact cartridge removably insertable into an open-ended housing of a first connector moiety for engagement with corresponding external contacts of a second connector moiety upon mating of the first and second moieties to make [in] a selectively separable multi-function electrical connection of a multi-conductor cable between a tow vehicle and a towed vehicle, each conductor of the cable having a termination contact connected to it within the first moiety housing, the cartridge comprising:

a nonconductive body having a first end and a second end and a plurality of openings extending from the first end to the second end;

an electrically conductive common cartridge contact member carried by the body and having a female contact end and an opposite contact end, wherein the female contact end is disposed in and the opposite contact end extends from a corresponding one of the plurality of openings, and wherein the female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of the female contact end within the body;

a plurality of electrically conductive noncommon cartridge contact members carried by the body and each having a female contact end and an opposite contact end, wherein each female contact end is disposed in and each opposite contact end extends from a corresponding one of the plurality of openings in the body, and wherein each female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of each female contact end within the body,

the cartridge body being sized and arranged to be insertable into and securable within the first connector moiety housing in a selected relation to the housing with each cartridge contact member in conductive engagement within the housing with a respective cable conductor termination contact at one end of the cartridge contact member and with the other end of the cartridge contact member disposed adjacent the open end of the housing so as to be engaged with a corresponding external contact of the second connector moiety upon mating of the first and second moieties.

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2. (Currently Amended) A multi-contact cartridge removably insertable into an open-ended housing of a connector moiety in a selectively separable multi-function electrical connection of a multi-conductor cable between a tow vehicle and a towed vehicle, each conductor of the cable having a termination contact connected to it within the housing, the cartridge comprising:

a nonconductive body having a first end and a second end and a plurality of openings extending from the first end to the second end;

an electrically conductive common contact member having a female contact end and an opposite contact end, wherein the female contact end is disposed in and the opposite contact end extends from a corresponding one of the plurality of openings, and wherein the female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of the female contact end within the body;

a plurality of electrically conductive noncommon contact members each having a female contact end and an opposite contact end, wherein each female contact end is disposed in and each opposite contact end extends from a corresponding one of the plurality of openings in the body, and wherein each female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of each female contact end within the body;

the cartridge body being sized and arranged to be insertable into and securable within the connector moiety housing in a selected relation to the housing with each cartridge contact member in conductive engagement with a conductor termination contact at one end of the contact member and with the other end of the contact member disposed adjacent the open end of the housing;

~~The cartridge of claim 1, wherein the first end of the body forms forming a plug-type moiety in conformity with SAE J560 and wherein the second end of the body forms forming a socket-type moiety substantially in conformity with SAE J560.~~

3. (Cancelled)

4. (Cancelled)

5. (Cancelled)

6. (Cancelled)

7. (Currently Amended) ~~The cartridge of claim 1, wherein a multi-contact cartridge removably insertable into an open-ended housing of a connector moiety for engagement with corresponding external contacts of a second connector moiety upon mating of the first and second moieties to make a selectively separable multi-function electrical connection of a multi-conductor cable between a tow vehicle and a towed vehicle, each conductor of the cable having a termination contact connected to it within the first moiety housing, the cartridge comprising:~~

a nonconductive body having an outer first end, and an inner second end and a plurality of openings extending from the first end to the second end,

an electrically conductive common cartridge contact member having a female contact end and an opposite contact end, wherein the female contact end is disposed in and the opposite contact end extends from a corresponding one of the plurality of openings, and wherein the female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of the female contact end within the body;

a plurality of electrically conductive noncommon cartridge contact members each having a female contact end and an opposite contact end, wherein each female contact end is disposed in and each opposite contact end extends from a corresponding one of the plurality of openings in the body, and wherein each female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of each female contact end within the body, each female contact end comprises comprising a groove that receives a sealing element received in the groove, such that the sealing element forms a seal between the female contact and the corresponding body opening in which the female contact end is disposed[.];

the cartridge body being sized and arranged to be insertable into and securable within the first connector moiety housing in a selected relation to the housing with each cartridge contact member in conductive engagement within the housing with a respective cable conductor

termination contact at one end of the cartridge contact member and with the other end of the cartridge contact member disposed adjacent the open end of the housing so as to be engaged with a corresponding external contact of the second connector moiety upon mating of the first and second moieties.

8. (Currently Amended) ~~The cartridge of claim 1, wherein~~ A multi-contact cartridge removably insertable into an open-ended housing of a connector moiety in a selectively separable multi-function electrical connection of a multi-conductor cable between a tow vehicle and a towed vehicle, each conductor of the cable having a termination contact connected to it within the housing, the cartridge comprising:

a nonconductive body having an outer first end, an inner second end and a plurality of openings extending from the first end to the second end, the second end of the body comprises a projection extending therefrom, and wherein the projection comprises and defining a keying lug[.];

an electrically conductive common contact member having a female contact end and an opposite contact end, wherein the female contact end is disposed in and the opposite contact end extends from a corresponding one of the plurality of openings, and wherein the female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of the female contact end within the body;

a plurality of electrically conductive noncommon contact members each having a female contact end and an opposite contact end, wherein each female contact end is disposed in and each opposite contact end extends from a corresponding one of the plurality of openings in the body, and wherein each female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of each female contact end within the body;

the cartridge body being sized and arranged to be insertable into and securable within the connector moiety housing in a selected relation to the housing with each cartridge contact member in conductive engagement with a conductor termination contact at one end of the contact member and with the other end of the contact member disposed adjacent the open end of the housing.

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9. (Currently Amended)- ~~The cartridge of claim 1, wherein the body comprises a length having~~A multi-contact cartridge removably insertable into an open-ended housing of a connector moiety in a selectively separable multi-function electrical connection of a multi-conductor cable between a tow vehicle and a towed vehicle, each conductor of the cable having a termination contact connected to it within the housing, the cartridge comprising:

a nonconductive body having a first end and a second end and a plurality of openings extending from the first end to the second end, the body having a length between its ends which is comprised by a front end portion adjacent to the first end of the body and a major portion extending from the front end portion of the body to the second end of the body, and wherein the front end portion has an outer diameter that is larger than an outer diameter of the major portion of the length[.] of the body;

an electrically conductive common contact member having a female contact end and an opposite contact end, wherein the female contact end is disposed in and the opposite contact end extends from a corresponding one of the plurality of openings, and wherein the female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of the female contact end within the body;

a plurality of electrically conductive noncommon contact members each having a female contact end and an opposite contact end, wherein each female contact end is disposed in and each opposite contact end extends from a corresponding one of the plurality of openings in the body, and wherein each female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of each female contact end within the body;

the cartridge body being sized and arranged to be insertable into and securable within the connector moiety housing in a selected relation to the housing with each cartridge contact member in conductive engagement with a conductor termination contact at one end of the contact member and with the other end of the contact member disposed adjacent the open end of the housing.

10. (Currently Amended) ~~The cartridge of claim 1, wherein said~~A multi-contact cartridge removably insertable into an open-ended housing of a connector moiety in a selectively separable multi-function electrical connection of a multi-conductor cable between a

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tow vehicle and a towed vehicle, each conductor of the cable having a termination contact connected to it within the housing, the cartridge comprising:

a nonconductive body having a first end and a second end and a plurality of openings extending from the first end to the second end;

an electrically conductive common contact member having a female contact end and an opposite contact end, wherein the female contact end is disposed in and the opposite contact end extends from a corresponding one of the plurality of openings, and wherein the female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of the female contact end within the body,

a plurality of electrically conductive noncommon contact members each having a female contact end and an opposite contact end, wherein each female contact end is disposed in and each opposite contact end extends from a corresponding one of the plurality of openings in the body, and wherein each female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of each female contact end within the body, the opposite contact end of the common contact member is defines a male contact and wherein said the opposite contact end of each of the noncommon contact members is defines a male contact[.];

the cartridge body being sized and arranged to be insertable into and securable within the connector moiety housing in a selected relation to the housing with each cartridge contact member in conductive engagement with a conductor termination contact at one end of the contact member and with the other end of the contact member disposed adjacent the open end of the housing.

11. (Original) A cable end plug assembly for removably electrically connecting a tow vehicle to a towed vehicle comprising:

a cable having a plurality of wires disposed therein;

a terminal electrically connected to each wire, wherein each terminal includes a first contact end;

a first insulative body overmolded to the terminals and a portion of the cable, such that the terminals and the overmolded portion of the cable are embedded in the insulative body, wherein the insulative body includes a first end having openings corresponding to and aligned

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with each terminal, such that the first end of the insulative body forms a first moiety of a multicontact first electrical connector;

a removable cartridge comprising:

a second nonconductive body having a first end and a second end and a plurality of openings extending from the first end to the second end,

an electrically conductive common contact member having a female contact end and an opposite contact end, wherein the female contact end is disposed in and the opposite contact end extends from a corresponding one of the plurality of openings, and

a plurality of electrically conductive noncommon contact members each having a female contact end and an opposite contact end, wherein each female contact end is disposed in and each opposite contact end extends from a respective corresponding one of the plurality of openings, and wherein the first end of the cartridge body forms a plug-type moiety of a second multicontact electrical connector and the second end of the cartridge body forms a second moiety of the first electrical connector, such that the cartridge forms a removable electrical connection with the first contacts of the first insulative body when the cartridge is mated to the first insulative body; and

a housing within which the first insulative body is disposed with the cable extending outwardly from one end of the housing, wherein the cartridge is removably mounted in an open opposite end of the housing so that said opposite ends of the cartridge contacts engage the first contacts of the first insulative body and establish a connection between the first and second moieties of the first electrical connector within the housing.

12. (Original) The cable end plug assembly of claim 11, wherein the first end of the first insulative body forms a plug-type moiety in conformity with SAE J560, the first end of the cartridge body forms a plug-type moiety in conformity with SAE J560 and the second end of the cartridge body forms a socket-type moiety substantially in conformity with SAE J560.

13. (Original) The cable end plug assembly of claim 11, wherein the second end of the cartridge body comprises a projection extending therefrom that mates with a recess in the first end of the first insulative body to ensure a particular arrangement of said opposite contact ends of the cartridge contact members with respect to the first contact ends of the first insulative body terminals.

14. (Original) The cable end plug assembly of claim 13, wherein the cartridge body projection comprises a keying lug that mates with a locating rib in the housing to ensure a particular orientation of the cartridge with respect to the housing.

15. (Original) The cable end plug assembly of claim 11, wherein the cartridge body comprises a front end portion adjacent to the first end of the cartridge body and a major portion extending from the front end portion of the cartridge body to the second end of the cartridge body, and wherein the front end portion has an outer diameter that is larger than each of an outer diameter of the major portion and an inner diameter of the housing that receives the outer diameter of the major portion, such that the front end portion of the cartridge body extends from the housing when the housing is attached to the cartridge.

16. (Original) The cable end plug assembly of claim 11, wherein the first insulative body comprises a flange adjacent to the first contact end of each terminal, and wherein each flange defines a diameter that is slightly smaller than an outer diameter of a corresponding one of said opposite contact ends of the cartridge contact members, such that when said opposite contact ends of the cartridge contact members are electrically connected to the first contact ends of the first insulative body terminals, each flange forms a seal with the outer diameter of a corresponding one of said opposite contact ends of the cartridge contact members.

17. (Original) The cable end plug assembly of claim 11, wherein the female contact end of each contact member has an outer diameter that is smaller than an inner diameter of the corresponding cartridge body opening in which it is disposed to allow for a lateral movement of each female contact end within the body.

18. (Original) The cable end plug assembly of claim 11, further comprising an end cap attached to the first end of the cartridge body, wherein the end cap comprises openings that correspond to and are aligned with each of the plurality of cartridge body openings, and wherein each end cap opening is smaller in diameter than an outer diameter of each female contact end to prevent each female contact end from axially extending beyond the first end of the cartridge body.



19. (Previously Presented) The cable end plug assembly of claim 18, wherein a junction between each female contact end and its corresponding opposite contact end forms a shoulder that engages a corresponding shoulder in the cartridge body opening in which the female contact end is disposed, such that each female contact end is axially constrained between the end cap and its corresponding cartridge body opening shoulder.

20. (Original) The cable end plug assembly of claim 11, wherein each female contact end comprises a groove that receives a sealing element, such that the sealing element forms a seal between the female contact and the corresponding cartridge body opening in which the female contact is disposed.

21. (Original) The cartridge of claim 11, wherein said opposite contact ends of the cartridge contact members are male contacts, and wherein the first contact ends of the first insulative body terminals are female contacts.

22. (Original) A method of making a cable end plug assembly for removably electrically connecting a tow vehicle to a towed vehicle comprising:

- providing a cable having a nonconductive covering that surrounds a plurality of conductive wires, wherein each wire comprises a separate nonconductive covering;

- removing a portion of the cable covering to expose a portion of the wire coverings:

- removing a portion of each wire covering to expose a portion of each wire;

- mechanically and electrically connecting a corresponding terminal to each wire;

- attaching each terminal to a corresponding attachment site on a mold load bar to space and orient the terminals in a particular arrangement;

- overmolding an insulative body to the terminals and a portion of the cable, such that the terminals and the overmolded portion of the cable are embedded in the insulative body;

- removing the load bar from the terminals, such that the overmolded insulative body forms a first moiety of an internal first connector of the plug assembly;

- providing a removable cartridge having a first end that forms a second moiety of the internal first connector and a second end that forms a socket-type moiety of a second

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electrical connector.

23. (Original) The method of claim 22, wherein the first end of the insulative body forms a plug-type moiety substantially in conformity with SAE J560, the first end of the cartridge body forms a plug-type moiety in conformity with SAE J560 and the second end of the cartridge body forms a socket-type moiety substantially in conformity with SAE J560.

24. (Currently Amended) The method of claim 22, wherein mechanically and electrically connecting a terminal to each wire comprises crimping ~~a second~~ an arm of the terminal to each corresponding wire.

25. (Currently Amended) The method of claim 24, wherein mechanically and electrically connecting a terminal to each wire comprises crimping a ~~first~~ second arm of the terminal to each corresponding wire covering.

26. (Original) The method of claim 24, wherein mechanically and electrically connecting a terminal to each wire comprises spot soldering a portion of the terminal to each corresponding wire.

27. (Original) The method of claim 22, wherein providing a removable cartridge includes:

providing a cartridge body having the first end and the second end and a plurality of openings extending from the first end to the second end;

providing a common contact member having a female contact end and an opposite contact end;

inserting the common contact member in a corresponding one of the plurality of openings, such that the female contact end is disposed in and the opposite contact end extends from the corresponding cartridge opening;

providing a plurality of noncommon contact members each having a female contact end and an opposite contact end;

inserting each noncommon contact in a corresponding one of the plurality of openings, such that the female contact end is disposed in and the opposite contact end extends

from the corresponding cartridge opening, wherein the female contact end of each contact member has an outer diameter that is smaller than an inner diameter of the corresponding cartridge opening in which it is disposed to allow for a lateral movement of the female contact end within the cartridge body.

28. (Original) The method of claim 22, further comprising moveably attaching a housing to the cable before the overmolding of the insulative body to the cable, wherein the housing removably houses the insulative body and a portion of the cartridge.

29. (Previously Presented) A cartridge for removably connecting to a cable useful to electrically connect a tow vehicle to a towed vehicle, the cartridge comprising:

a nonconductive body having a first end and a second end and a plurality of openings extending from the first end to the second end;

an electrically conductive common contact member having a female contact end and an opposite contact end, wherein the female contact end is disposed in and the opposite contact end extends from a corresponding one of the plurality of openings, and wherein the female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of the female contact end within the body;

a plurality of electrically conductive noncommon contact members each having a female contact end and an opposite contact end, wherein each female contact end is disposed in and each opposite contact end extends from a corresponding one of the plurality of openings in the body, and wherein each female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of each female contact end within the body; and

an end cap attached to the first end of the body adjacent to which end the contact ends of the contact members are disposed, the end cap defining openings that correspond to and are aligned with each of the plurality of body openings, and each end cap opening is smaller in diameter than an outer diameter of each adjacent female contact end to prevent each female contact end from axially extending beyond the first end of the body.

30. (Previously Presented) The cartridge of claim 29, wherein a junction between each female contact end and its corresponding opposite contact end forms a shoulder that engages a corresponding shoulder in the body opening in which the female contact end is disposed, such that each female contact end is axially constrained between the end cap and its corresponding body opening shoulder.

31. (New) A multi-contact cartridge removably insertable into an open-ended housing of a first connector moiety for engagement with corresponding internal contacts of the first moiety and with corresponding external contacts of a second connector moiety upon mating of the first and second moieties to make a selectively separable multi-function electrical connection between a tow vehicle and a towed vehicle, the cartridge comprising:

- a nonconductive body having a first end, a second end, and a plurality of openings extending from the first end to the second end;

- an electrically conductive common cartridge contact member carried by the body and having a female contact end and an opposite contact end, the female contact end being disposed in a corresponding one of the plurality of openings, and the female contact end having an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of the female contact end within the body;

- a plurality of electrically conductive noncommon cartridge contact members carried by the body and each having a female contact end and an opposite contact end, each female contact end being disposed in a corresponding one of the plurality of openings in the body, and each female contact end has an outer diameter that is smaller than an inner diameter of the corresponding body opening in which it is disposed to allow for a lateral movement of each female contact end within the body,

- the cartridge body being sized and arranged to be insertable into and securable within the first connector moiety housing in a selected relation to the housing with each cartridge contact member in conductive engagement within the housing with a respective internal contact of the first moiety at one end of the cartridge contact member and with the other end of the cartridge

contact member disposed adjacent the open end of the housing so as to be engaged with a corresponding external contact of the second connector moiety upon mating of the first and second moieties.

32. (New) A multi-contact cartridge removably insertable into an open-ended housing of a connector plug at one end of a multi-conductor cable useful to make a multi-function electrical connection between a tow vehicle and a towed vehicle, each conductor of the cable having a termination contact connected to it within the housing, the cartridge comprising:

- a nonconductive body having an outer end, an inner end, and a plurality of holes extending through the body between those ends;

- an electrically conductive common cartridge contact member having a female contact end and an opposite contact end and disposed in a corresponding one of the plurality of cartridge body holes, the female contact end is disposed in its hole adjacent the outer end of the body and has an outer diameter that is smaller than an inner diameter of the corresponding body hole to allow for a lateral movement of the female contact end within the body;

- a plurality of electrically conductive noncommon cartridge contact members each having a female contact end and an opposite contact end and disposed in corresponding ones of the other cartridge body holes, each noncommon contact member female contact end having an outer diameter that is smaller than an inner diameter of its hole to allow for a lateral movement of the female contact end within the body.

The cartridge body being insertable into and securable within the plug housing in a selected relation to the plug housing with the opposite end of each cartridge contact in conductive engagement within the plug housing with a respective cable conductor termination contact and with the outer end of the cartridge body disposed adjacent the open end of the plug housing.